



American Water Works
Association

The Authoritative Resource on Safe Water®

Improving Municipal Water Demand Forecasting

J. Alan Roberson, P.E. - Director of Federal Relations
American Water Works Association
Washington, DC

Presentation Outline

- The research questions
- Why demand forecasting is important
 - Factors impacting demand forecasting
- The research team
- The research process and results
- Recommendations for water systems
- Future research needs



Research Questions

- How might future climate change impact water demand forecasting as compared to other factors such as changing demographics, increased use of low-flow plumbing fixtures, etc.?
- How might one understand and decrease the uncertainties in water demand forecasting?

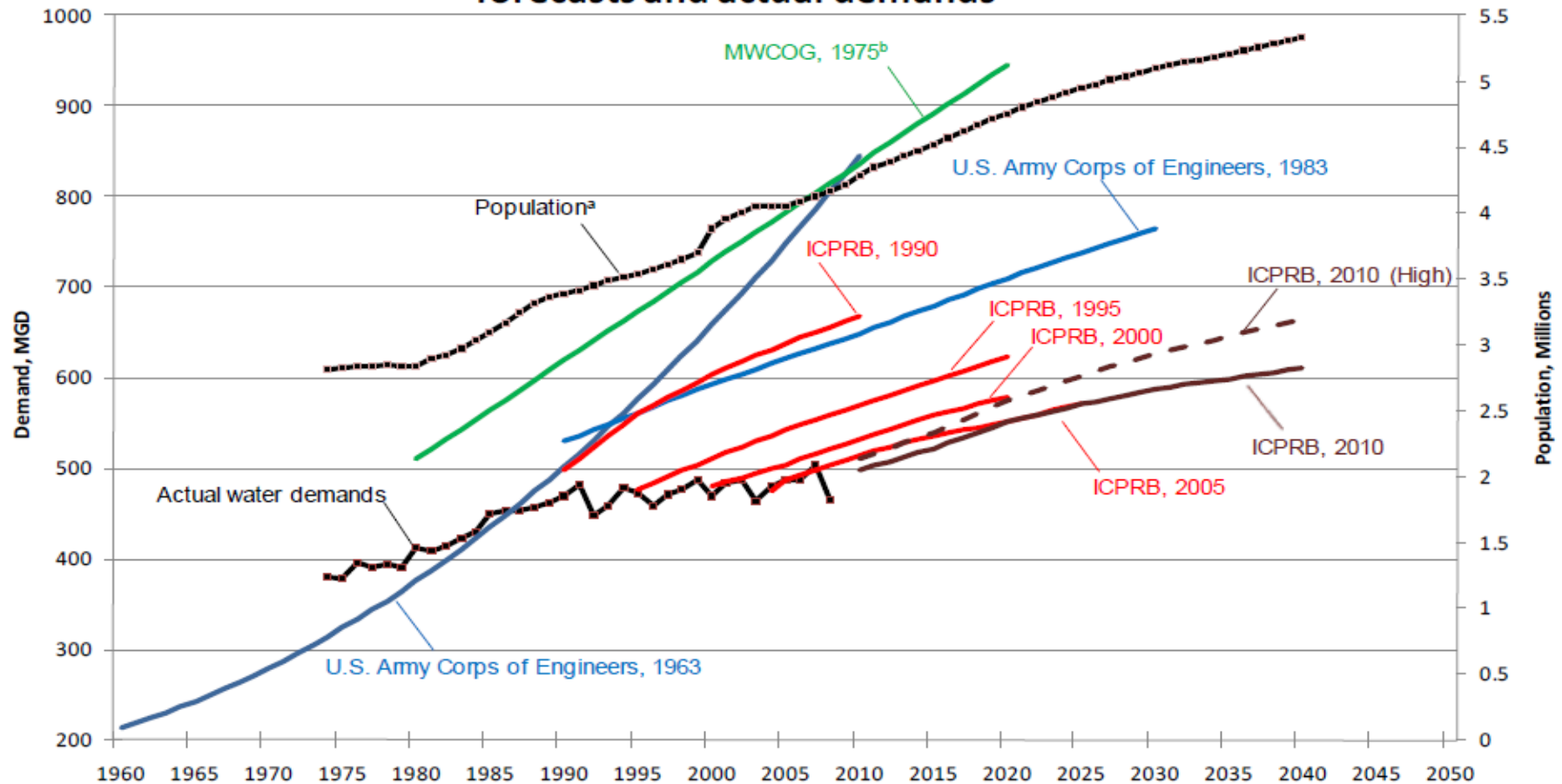


Why is A System's Future Water Demand Important?

- Demand is the other half of water budget
- Future water demand = water sales = \$\$
- Accurate demand forecasts are important
 - Not meeting predicted/desired water sales and gross revenues and bond coverage ratios
 - Stretched utility assets and less reliability
 - Stranded utility assets
 - Facility expansions being ahead of the need
 - How can we lower the risk of being wrong?



Washington metropolitan area average annual water demand, forecasts and actual demands



^a Population is a sum of the populations within Montgomery, Prince George's, Prince William, Loudoun, Fairfax, and Arlington Counties, as well as the District of Columbia, according to data provided by the U.S. Census Bureau.

^b As cited in U.S. Army Corps of Engineers, 1975



What Impacts Demand Forecasting?

- Most water systems have seen lower per capita demand in the past five or ten years
- What are the factors causing this??
 - Increased use of low-flow plumbing fixtures
 - Socioeconomic factors
 - Change in lot sizes, family sizes, etc.
 - Recession – new Water Research Foundation project
 - Attitudes/behaviors
 - Conservation ethic, response to higher rates, etc.
 - Weather – extreme weather or climate change



Demand Forecasting

- Gallons per capita per day (gpcd) times population is still widely used
 - Simple, well accepted
 - 5-year or 10-year rolling average can be used
 - » Slow to account for decreasing gpcd
 - Could miss flattening of indoor use
 - » Could also miss future economic downturns
 - What is the “new normal”?



The Research Team

- American Water Works Association – PI
- Kearns & West
 - Environmental facilitator
- George Washington University (GWU)
 - Literature review on models
- University of Colorado (CU)
 - Extreme value analysis
- Hazen and Sawyer



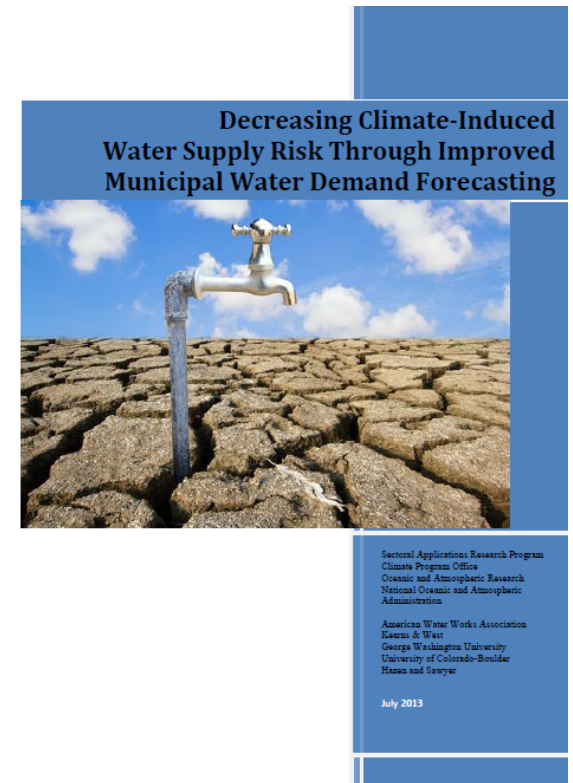
The Research Process

- GWU - Literature search on model types
- CU - Extreme value analysis
- AWWA and K&W started stakeholder process through interviews & surveys
- Two workshops in 2011 – DC & Denver
 - Mix of utilities, consultants, & academics
 - Blend of demand experts and management



Research Process (cont.)

- Late 2011 – First draft of report
- First half of 2012 – The two key sections (recommendations and research needs) refined through webinars
- July 2013 - Final report completed



Research Results - GWU

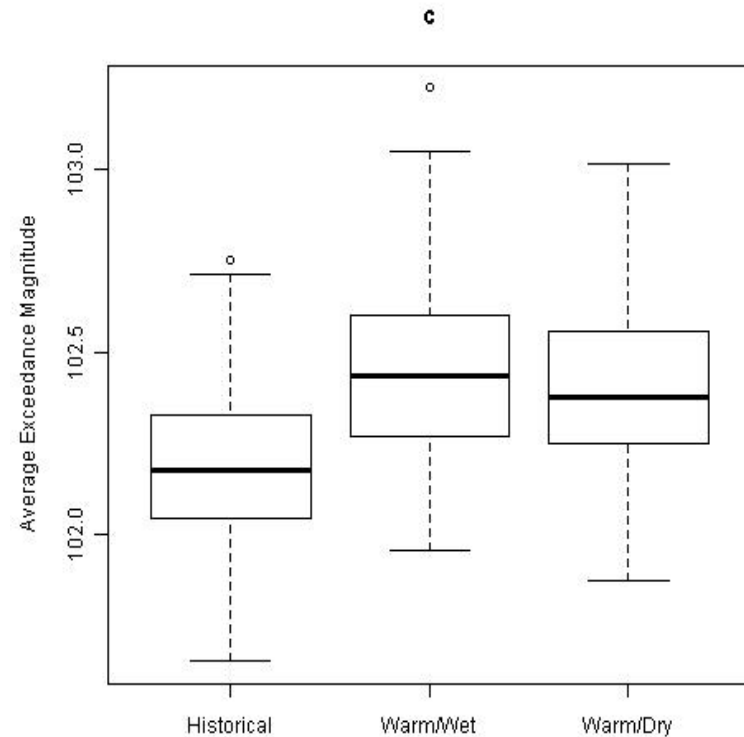
- Wide range of demand models used
 - Range from simple to complex
 - Gpcd X population is still widely used (simple)
 - Complex models require a certain level of knowledge/sophistication of utility planning staff
- Model timeframe is important
 - Short-term demand for operations staff
 - Medium/long-term for planning staff

From Donkor, et al, ASCE Journal of Water Resources Planning and Management



Research Results - CU

- Risks are inherent with any forecasting
- Simple approach
 - Scenario of 10% increase in demand, and decrease of 10% in supply
- Extreme value analysis is a more complex approach to project water demand extremes



From Haagenen, et al, Feb. 2013 Journal - AWWA



Recommendations

1. Collect the necessary data
2. Analyze water use and related data
3. Evaluate potential changes in demand
4. Evaluate potential changes in demographics
5. Understand & incorporate uncertainty
6. Plan for drought to be able to cope with it



Data Recommendations

- Collect and process more weather data
 - Beyond daily temperature and precipitation
 - Threshold – number of days past threshold
- Collect and process more demand data
 - More categories for demand data is better
 - Outdoor water use changes substantially
 - Ability to restrict outdoor demand
 - Potential for “demand hardening”



Evaluation Recommendations

- Many factors changing
 - Increased use of efficient plumbing fixtures
 - Socioeconomic factors
 - Customer attitude and behaviors
 - Climate change and extreme weather events
 - Demographics
 - Understand the uncertainties behind forecasts of population and job growth



Understanding Uncertainty

- Future demand shown as a straight line
 - Mistaken impression of confidence
 - Management and governing boards needs to understand uncertainties as they impact future investment decisions
- Drought is not uncertain
 - Every system needs a drought plan
 - Plans need to be re-evaluated on a regular basis



Research Needs

- Understanding baseline conditions and potential changes to the baseline
- Potential impacts of demand on design
 - Have peaking factors changed over time?
- Minimum system data set
 - More detailed information on demand/sales from different customer class categories
- Data integration and information management research



More Research Needs

- Historical drought/water shortage analyses
 - Has demand been reduced as predicted after water restrictions?
- Value of information (VOI) studies
 - VOI studies not used by water sector
 - How much should you spend now to reduce the uncertainty about a future decision?
- Social science studies



QUESTIONS?

J. Alan Roberson, P.E.
Director for Federal Relations
Email: aroberson@awwa.org
Direct: (202) 326-6127

American Water Works Association
Government Affairs Office
1300 Eye Street, NW, Suite 701W
Washington DC 20005
Gen. Office: (202) 628-8303

I want to be here for you.

If only our water infrastructure could talk to us. The corner hydrant might remind us that only tap water protects us against the threat of fire, and that the pipes below our streets need constant attention to keep life-saving water flowing at the right pressure, 24/7, without fail.

We are all stewards of the water infrastructure generations before handed down to us, and our water bills keep that system strong and reliable. For more



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